Partnering to cofire woody biomass in central Florida

S. A. Segrest[a], D. L. Rockwood[*b], J. A. Stricker[c], G. R. Alker[b]
[a]The Common Purpose Institute, Gainesville, FL, USA 32611-0410
Fax: 352-846-1277; dlr@gnv.ifas.ufl.edu
[b]School of Forest Resources and Conservation, Box 110410, [c]Polk County/University of Florida.Cooperative Extension Service

In central Florida, numerous partners have combined to demonstrate the potential for growing short rotation woody crops (SRWC) for cofiring at utilities with up to 13,000 MW of capacity. Since 1997, the Common Purpose Institute has conducted cofiring studies and developed partnerships for SRWC planting and use. These partnerships build on more than two decades of SRWC research by the School of Forest Resources and Conservation at the University of Florida (UF) that has identified species and cultural options for commercial cropping [1,2,3]. Cofiring up to 5% SRWCs is the most cost effective means of creating renewable energy while using existing power plant infrastructure.

A 123 acre SRWC demonstration planting on a clay settling area (CSA) near Lakeland is one fruition of this collaboration. Approximately 160,000 ha of similar mining sites and unimproved pastures are a potential SRWC land base in central Florida [4]. Initiated in 2000, the SRWC demonstration is 1) documenting "real world" SRWC costs and yields, 2) developing guidelines for establishing and managing SRWCs on CSAs, and 3) evaluating genetic, cultural, and harvesting options for further improving the cost effectiveness of using cottonwood (**CW**, *Populus deltoides*), *Eucalyptus amplifolia* (**EA**), and *E. grandis* (**EG**) as SRWCs.

EA, **EG**, and **CW** are highly productive, in part due to tree improvement research by the USDA Forest Service (FS), UF, and/or Mississippi State University with support from public and private partners such as the US Department of Energy, Tennessee Valley Authority (TVA), and Lykes Bros. **EG** is suited to frost-infrequent areas and coppices best in the winter months, while **EA** is ideal for more frost-frequent areas and coppices prolifically throughout the year [2] and **CW** has no cold weather constraints in Florida.

For the SRWC demonstration, very productive genotypes of **EA**, **EG**, and **CW** have been included. Superior seedlots of **EA** and **EG** were selected from ongoing tree improvement programs that include a 1st-generation **EA** seed orchard, a 4th-generation **EG** seed orchard, and hybrids developed in association with Shell International. More than 500,000 **EA** and **EG** seedlings have been produced by LaBelle Plant World at very favorable prices. Cuttings of superior **CW** clones [5] were secured from commercial nurseries in Mississippi and a UF clone bank under partial support provided by the UF Center for Natural Resources. Fast-growing slash pine taxa from the Queensland Forest Research Institute will also be tested.

Establishment of the SRWC demonstration was possible due to funding from the Florida Energy Office, Tampa Electric Company (TECO), and the Florida Institute of Phosphate Research. Initial site preparation using conventional forest site practices and herbicides partially underwritten by Monsanto effectively controlled cogongrass (*Imperata cylindrica*). Final bedding and planting by Natural Resources Planning Services resulted in very good tree establishment and growth. As possible, the demonstration has included yard wastes from the City of Lakeland and Plant City for site amendments and weed control.

Research studies imbedded in the demonstration assess genetic and silvicultural factors that may enhance SRWC productivity. The factors include genotypes within the three species, fertilizers, and planting configurations. **EA** and **EG** seed orchards are being developed, and a six-acre **CW** clonal nursery will produce cuttings for future commercial plantings.

Growth expectations for **EG** and **CW** in the SRWC demonstration are high based on their growth elsewhere

in central Florida. Since March 1998 with support from the City of Orlando/Orange County and the Florida Center for Solid and Hazardous Waste Management, **EA**, **EG**, and **CW** have been monitored in a sewage effluent application study on sandhills west of Orlando. Significant culture and genetic effects have been observed as sewage effluent alone (E, 17mm day^{-1}) resulted in the slowest growth and lowest survival. With compost (E+C), survival and height increased. Mulching in addition to the effluent (E+M) increased overall survival, but tree height was comparable to E+C. With E+C+M, survival and height were highest. **CW** and **EA** did not effectively suppress weed competition, especially in the E only culture and grew most under E+C+M. E+C+M culture of **CW**, **EA**, and **EG** was recommended for maximum growth and survival. A recent analysis funded by the UF Water Resources Research Council has generated models of water and nutrient uptake by **EG** and **CW** under a range of cultural and environmental conditions that can be extended to our SRWC demonstration.

While **EA**, **EG**, and **CW** growth on CSAs in central Florida is expected to be high [1,4], SRWC cost competitiveness will be very dependent on harvesting costs. Approximately 66% of the cost of delivered energywood may be due to harvestingwith conventional feller-bunchers. Because double row harvesters such as the Claas have great promise for reducing harvesting costs, our SRWC demonstration includes double row as well as single row planting configurations. By monitoring productivity and assessing harvesting regimes in both configurations, we anticipate bracketing the range of feasible management options for CSAs.

Cofiring of the biomass from the SRWC demonstration will follow protocols established by several test burns at Lakeland Utilities [1] and TECO. The UF Mechanical Engineering Department participated in an assessment that indicated that cofiring as high as 10% was possible. A Summer 2001 test burn will extend cofiring assessments to more efficient power generation units.

All components of this partnership are actively updating preliminary comprehensive analyses commissioned by National Renewable Energy Lab [4] and TVA [1]. A Model Biomass Contract has been developed with cooperation from Lakeland Utilities and area landowners [6]. The project Enhancing Community Support for Renewable Energy Programs has created a planning committee to inform environmental organizations of the benefits of renewable energy from biomass. The exceptional collaboration described above among public and private partners is very promising for commercializing SRWC in central Florida.

References

[1] Segrest SA, Rockwood DL, Stricker JA, Green AES. Biomass cofiring with coal at Lakeland Utilities. Southeastern Regional Biomass Energy Program Publication No. 219287-1, TVA, Muscle Shoals, AL, 1998, 50p.

[2]Rockwood DL. 1997. Eucalyptus - Pulpwood, Mulch, or Energywood? Florida Cooperative Extension Service Circular 1194, 6p.

[3]Stricker JA, Alker GR, Rockwood DL, Prine GM, Segrest SA. Short rotation woody crops for Florida. Proc. Short Rotation Woody Crops Operations Working Group, Syracuse, NY, October 11-13, 2000.

[4]Stricker JA, Mishoe JW, Prine GM, Rahmani M, Rockwood DL. Economic development through biomass systems integration in central Florida. Proc. 2nd Biomass Conf. of the Americas, August 21-24, 1995, Portland, OR, p. 1608-1617.

[5]Rockwood DL, Pisano SM, McConnell WV. 1996. Superior cottonwood and Eucalyptus clones for biomass production in waste bioremediation systems. Proc. Bioenergy 96, 7th National Bioenergy Conf., September 15-20, 1996, Nashville, TN, p. 254-261.

[6]Stricker JA., Segrest SA, Rockwood DL, Prine GM. 2000. Model fuel contract: Co-firing biomass with coal. Soil Crop Sci. Florida Proc. 59:98-102.